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ABSTRACT

This paper begins defining conversation as the alternate of pro and con opinions between interactors that emphasizes the sequential and discrete nature of interaction. After reviewing the few studies that have analyzed natural interaction sequentially, a theoretical framework is proposed: interactors are decision makers who generate choices over time based on a memory of the recent past and an expectation of immediate future outcomes. This framework led to hypotheses about memory's size, organization, and distortion, about decision rules, and about outcome structures and value determination. The various hypotheses are partially used in formal models that represent these processes. A sample conversation is analyzed to demonstrate the models and not to draw support for the hypotheses. Many hypotheses can be represented through this model. (KJ/Author)

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A Model of Conversation

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There are many conceptualizations of two person (dyadic) social interaction. Conversation, the exchange of pro and con opinions, is just one kind of interaction. In order to analyze conversation, thinking about interaction must be put straight.

Most conceptions of interaction start with theoretical properties of the interactors or of their task and social environments. Either of these properties, various interpersonal decisions and motives, perceptions and awareness are measured at a single time point, or time dependent data are summed over time. Hypotheses about how choices relate are tested by static correlational analyses.

Limitations in this approach (See Marlow and Gergen (1968) for a review) stem not from trying to explain time dependent choices during interaction with time independent explanatory variables, but from inadequate conceptualization of time dependent interaction, its measurement and analysis. As Raush (1965) notes, one would not try to explain or describe chess by recording just the frequency of moves of each piece on a chess board. Similarly, one should not

expect to find out much about dyadic social interaction just by correlating the frequency of interpersonal choices.

A distinctly different conceptualization process starts with the observably obvious sequential, time dependent nature of interaction and the discrete choices available to each interactor. The purpose of this paper is to abstract from studies of time dependent natural and laboratory interaction three time invariant properties - an outcome, a decision, and memory - and a Markovian model (Kemeny and Snell, 1960) of conversation based on this abstraction. Another paper presents a test of the model in an empirical situation, and a sensitivity analysis. In this paper intuitive knowledge of the phenomena of dyadic interaction is assumed. This paper contains descriptions of sequential interaction, a theory of interaction, and a formal model.

The following sections do not present a detailed analysis of the nuances in the interaction of, for example, George and Martha in Who's Afraid of Virginia Woolf. It might appear that the abstractness has taken away the humanness of social interaction. The purpose, however, is not to mechanize a complex puzzle but to combine ideas on sequences. In their simplicity these ideas provide a heuristic way of viewing processes that go on within people during conversation.

A central concept is that of a choice. It implies the presence of alternatives. Interpersonal choices within dyadic

interaction are alternative behavioral messages. The messages are discriminated one from another according to their unit meaning and size, smaller than a paragraph to larger than a pheneme (Bales, 1950). Typically, this means a message is a sentence or phrase that informs who does what to whom. The main requirements are that the messages be reliably coded (Weick, 1968), and interpersonally meaningful (Longabaugh, 1963). The message may be content-free verbal activity but it remains to be seen if verbal activity distinguishes kinds of interaction such as conversation.

There can be many kinds of choices in social interaction. Conversation, however, is a particular kind of interaction. It occurs in a task context that requires neither original choices (as in a creative interaction task) nor solution choices (as in a problem solving interaction task). It requires more than sheer activity and usually occurs in a staggered or cyclic manner of alternation between interators (Miller, 1963). The interpersonal nature of choices emerges through sequential analyses.

Given the definition of conversation as an exchange of opinions, elementary messages in conversation as contrasted with original messages in creativity tasks and directive messages in problem solving tasks are the seeking and offering of pro and con opinions. Attitude change situations have emphasized only the pro and con evaluations (Cervin and Henderson, 1961;

Abelson, 1967). From an exchange point of view the failure to use seeking messages in attitude change studies is unrealistic and can affect the final change of attitudes (Cassagrande and Longabaugh, 1967).

Insert Figure 1 about here

Analysis of the pairs of the elementary four conversational messages (See Figure 1) shows that three responsive messages can be derived. These responsive messages - complying, confronting and questioning - are more directly related to the conversation process than are the elementary messages, but the elementary messages are more directly related to the final outcome of the conversation. In this analysis the process is of more interest than the final agreement or disagreement. Therefore, the derived variables of complying, confronting and questioning are focused upon. This emphasis is different than that of Abelson (1967), Raino (1962), or Cervin and Henderson (1961).

We can now turn to how these variables interrelate. This is done by starting with analyses of natural social interaction.

Sequential Social Interaction

Few have conceptualized and/or observed natural social interaction as a sequential phenomenon. Barker and Wright (1954) and Barker (1963) note, through natural ecological observation of children and behavior, that strings of inter-

action occur in different sizes and that the smaller sizes may overlap each other and/or nest within larger strings of interaction. This observation is similar to that of Goffman (1968) in describing adult interaction as a "dramatic interaction ritual". In a similar vein, popular observers of interaction, Potter (1951) and Berne (1964) describe particular interaction sequences usable for status, ego or monetary gain.

To identify the patterning of sequential interaction, Raush (1965) used conditional and joint probabilities (usable in a Markov Chain), and its mathematical transformation, statistical uncertainty (Attneave, 1959). Raush (1965) showed, in the observation of children's interaction in several settings, that the prior choice and a given situation account singly and in combination for approximately 50% of the variance (uncertainty) in the next choice. This result was used in a first order Markov model (Kemeny and Snell, 1960) to predict long run, equilibrium choice probabilities.

In an extension of these kinds of analyses, Wolf, Longabaugh, and Eldred (1969) analyzed interaction sequences from staff and patients on a ward in a mental hospital. The prior three choices, not just the immediately preceding one, were shown to constrain less and less the probability of a subsequent choice. The three prior choices together accounted for more than 60% of the variance. This result indicates that a first order Markov Chain is probably not appropriate for natural interaction and that

an interaction sequence consists of strings of choices of varying length.

In the Raush and Wolf, et al. studies, the person who performed the prior choice in the interaction sequence was not distinguished, and data were summed over the sample so that the variability of interaction sequences from dyad to dyad could not be identified. Because of these reservations, the results might be only a product of summing over different kinds of interaction. These studies do show, however, that any dyadic interaction, from beginning to end, can usefully be thought of as containing a degree of statistical dependence of discrete choices. These choices may range from random (the unlikely zero order in which choices are like flips of a coin) to unique (no sequence recurs throughout the contact).

Analysis of choice sequences in natural interaction may be expressed formally as an n^{th} order Markov Chain, recognizing that in conversation choices are staggered (Miller, 1963):

$$1) \quad q^t = p^o_{(n)} \; p^t_{(n)} \; E$$

where, t = trials or observation points, $1,2,\ldots,n$.

q = vector of the probabilities of the two parties' choices, sum of which is 2.

$p^o_{(n)}$ = initial n^{th} order stochastic vector, $2k^n \times 1$, each row consisting of n sequential choices, and k the number of choices of each interactor.

$p_{(n)}$ = transition matrix, $2k^n \times 2k^n$, each row and each column consisting of n sequential choices and rows summing to 1; and k = number of alternative message choices.

E = an $2k^n$ x 2k incidence matrix of zeros and ones; only of computational use to obtain q.

This formalization, similar to that used by Raush and Wolf et al., and to simultaneous choice model by Jaffe and Norman (1964) and Rapoport and Chammah (1965), is intended to be representational and not explanatory (Berger, Cohen, Snell and Zelditch, 1962). A representational model allows use of a formal theory to make predictions. In this case the expected long run probability of a choice can be predicted, but theoretical reasons for the system's exhibiting n^{th} order patterning or uncertainty are beyond the model.

From the representational model of the sequential observation of natural interaction pattern and randomness are obvious phenomena to be explained. The pattern of interaction has two parts: how long the sequence is and what choice follows what choice in the sequence. Randomness occurs in interaction when knowing any more about the sequence, its length and/or order, does not change the probability of the next choice occurring. Thinking of an interactor as a decision maker provides a means of explaining pattern and randomness properties of conversational interaction.

Theory

An interactor acts as a decision maker if he makes a choice based on the value of its consequences. If the value of a choice, an average value of all consequences of a choice, does not depend on where in a sequence the choice occurs, then choices

need not be contingent on prior choices. But choices do depend on the pattern of past choices. This pattern we define as an interactor's memory. Therefore, the immediate value of a choice must depend on the pattern of past choices. This means that the value of a sequence is not just the sum of the values of each of the choices in the sequence. If a sequence has higher value than the sum of the values of the individual choices, interactors will be motivated to generate a particular sequence and not just a collection of choices in any order. What sequential patterns have high value or low value? Is there a limit to how long the sequence can be? These questions about pattern are considered in sections on outcomes and memory.

Randomness may come either from uncertain choices or from a distortion of memory. The first concerns the decision rules, such as maximization of outcome values, maximum uncertainty reduction, or maximization of information. The second concerns memory of either other's choices or own choices in a sequence. Distortion of other's choices is called attribution, and distortion of own choices is called dissonance.

Decisions, memories and outcomes are detailed in the following section. Generally, these ideas agree with Sears' (1951) and Bateson's (1956) conceptualization that a choice in interaction serves three functions: past stimulus, present response and future incentive or reward. The present conceptualization is also somewhat similar to the highly constrained one

person probability learning situation in which the experimenter presents a small set of blinking light bulbs (A's choices) to a subject who must predict (B's choices) on each trial which light will occur. Conversation and probability learning differ mainly in that in the former both interactors choose a strategy in relation to the other and in the latter the experimenter's strategy is a priori and mechanical. They are similar in that in both two decision makers generate choices over time responsive to the past and expectant of the future.

Memory

Because a decision is a choice contingent on the memory of recent interaction, there are three issues in the analysis of memory: the size, structure and distortion of memory. The following discussion disagrees with Coleman's (1964) conclusion that higher order models that represent memory are not useful.

Size: The memory for recent interaction represents a limited but large information pool, record, or stimulus with which an interactor deals. The memory, in the sense of a record of history, may or may not be conscious. For example, Altmann (1965), in the observation, coding and uncertainty analysis of primates' social behavior, found dependence of primates' social choices over a string of five acts. This dependence was called "social memory".

Based on the uncertainty statistic analyses of Raush (1965), Wolf, et al. (1969) and Hayes, Meltzer and Wolf (1970), the

size of memory (length of the longest sequence recorded) depends on the usefulness of information compared to the cost of processing it. This is an economic trade off. As memory becomes larger the costs of storage and retrieval probably increase and the value of a patterned sequence probably decreases.

There are upper boundaries on the size of memory, or order of the recorded sequence of choices. The length of conversation, as measured by the number of performed choices in the conversation, and the number of choices available to an interactor are the two boundary conditions. These two can be put precisely as $s = m - n$ and $s = \alpha k^n$ where s is the number of memory states, m the number of performed choices, n the order or size of memory, k the number of available choices and α a constant of 2 or 1 depending on the cyclic or ergodic properties of the interaction. These relationships can be found in Figure 2.

Insert Figure 2 about here

If conversation is sufficiently long, $m > 100$, and the number of choices is moderate, $k > 5$, then the number of memory states and in turn the memory size or order will not hit these boundaries. With generous boundaries the value of memory size and cost of information retrieval from memory determines the size of memory. With minimal boundaries, the economic considerations of memory play only a small role in the determination of

memory size.

Without knowledge of the value and cost functions of memory, memory size or order can still be computed by using uncertainty analysis (Garmer, 1962). This will be demonstrated in an example in a later section and was used by Raush and Wolf et al.

Organization: We turn to laboratory studies in order to specify the organization of memory and its relation to decisions. Laboratory studies constraining choices to either simultaneous or staggered allow specification of who performed which choice prior to who performed another choice. Usually the choices have been analyzed for the dependence of a choice by A on both the prior choice by A and/or prior choice by B. The following concentrates on this case which can be generalized to any number of prior choices. If the choices by A and B are considered random variables, then a decision, i, for A given prior decision, j, by B and k, by A is

$$2)\quad pr(A_t = i \mid B_{t-1}=j,\ A_{t-2}=k,\ldots,A_{t-n}=n) =$$

$$pr(A_t=i \mid B_{t-1}=j,\ A_{t-2}=k) = a_{ijk}.$$

A similar equation can be presented for B's decisions. Three decisions have been proposed that reflect a kind of memory structure.

The first is

$$3a)\quad a_{ijk} = a_{ihk}.$$

This simply says that A's choice is dependent not on B's choice but only on his own prior choice. This structure has been

interpreted in gaming (Rapoport and Chammah, 1965) and verbal activity (Jaffe and Norman, 1964) as dependence on self or independence of other, and in attitude change (Abelson, 1967) and verbal conditioning as self persuasion or pseudo-dependence. If each party made decisions based only on this structure, i.e., do unto other that which you just did unto him, this apparent interpersonal behavior would scarcely qualify as interaction. At the other extreme, if this structure is not used, probably neither party will exhibit a self consistency or personality tendency and the interaction will be aberrant.

The next structure places dependence only on the other:

$$3b) \quad a_{ijk} = a_{ijh}.$$

Jones and Gerard (1967) call this reactive dependence, while others have called it dependence on other (Rapoport and Chammah, 1965; Jaffe and Norman, 1964) on other's persuasiveness (Abelson, 1967). Following only this structure of do unto other that which he did unto you would also produce an aberrant kind of interaction in which one is controlled only by the other's choices.

The last structure encompasses a prior choice by A and B and is variously called reinforcement or win-stay lose-change (Atkinson, Bower, and Crother, 1965):

$$3c) \quad a_{ijk} = a_{ikj}.$$

This structure can be said to describe feedback. The probability that A changes his choice i from previous performance is dependent on whether B performs choice j. This variation on the Golden [illegible] by other's [illegible] encouraged [illegible] to [illegible] him.

Golden Rule is do unto other that which he encouraged you to do unto him.

Often only one of these decision structures is looked at in a given situation, or one structure is used in a model and results are compared to results with a model that uses another structure. (Feldstein, 1965; Rapoport and Chammah, 1965; Wolf, 1967). An alternative is to treat the structures as used simultaneously by an interactor in varying degrees. This can be formally done in an analysis of variance model if generalization over interactions is required, or using uncertainty statistics (Garner, 1962) for a single interaction. The linear, fixed factor, two way analysis of variance model is

$$4) \quad a_{ijk} = u_i + \alpha_{ik} + \theta_{ij} + (\alpha\theta)_{ijk} + e_{ijkh}$$

where,

u_i = mean of the i^{th} choice over all prior memories,

α_{ik} = cue effect of own prior choice, k, on own choice i, where $\sum_k = 0$; decision rule 3a,

θ_{ij} = cue effect of other's prior choice, j, on own choice i, where $\sum_j = 0$; decision rule 3b,

$(\alpha\theta)_{ijk}$ = feedback effect on own and other's prior choices j and k, on own choice i, when $\sum_{jk} = 0$; decisions rule 3c,

e_{ijkh} = error measuring differences between h different persons.

The model says that for each choice, i, the effects of prior two choices in the sequence that hold over, h, observed persons (possibly from different dyads but similar interaction situations)

may operate singly (α_{ik},θ_{ij}) or in combination ($(\alpha\theta)_{ijk}$). These dependence parameters can be estimated as a repeated measures design (Winer, 1962), but care must be taken for correlated error (Johnston, 1966).

The parameters can be interpreted in terms of "meaning" as well as in terms of the effect of memory's organization on choices. One aspect of meaning is its variation with the context (Garner, 1962). In the present analysis, the memory structure represents a context and the size of dependence parameters measures the kind of meanings attached to an interpersonal choice. The meaning of a choice is composed of the effect of other, the effect of self and the effect of both interactors. Results from this structure using as a measure the probability of an interactor speaking show that what appears to be a dialogue is more like two monologues (Hayes, Meltzer, and Wolf, 1970). An analysis of Prisoner's Dilemma games shows greater cue effects than feedback effects (Wolf, 1969). In terms of meaning and memory structure, these results indicate that a choice in interaction reflects greater remembrance of acts by self or other than of combinations of acts.

Using memory as a context for the meaning of an interpersonal choice has implications for research and gives rise to questions. What if a particular choice in a sequence were different or had not occurred? According to the previous analysis, a choice is related in differing strengths to prior choices,

singly or in combination. Therefore, if a choice had only low strength relation to other choices, its elimination would not change a conversation. Some examples of this phenomena from communication research are the elimination of pauses and speech mistakes from lectures or of prepositions and conjunctions from written material. Results of these eliminations show that comprehension of the communication is not lowered. An elimination procedure could be done experimentally or analytically in conversation research in order to verify the differing strengths among conversational choices. Experimentally, written messages between parties could be edited so that either strong or weak links between choices are eliminated. Analytically, a coded conversation could be edited in various ways to achieve a similar end.

In summary, the concept of memory's organization of recent conversational choices attempts to encompass the intuitive idea that interaction exhibits patterns and that choices in a pattern have meaning because of the pattern.

This procedure of using analysis of variance or uncertainty analysis could be generalized to a sequence of any order. The number of possible dependencies as represented by decision structures would grow exponentially. However, if parts of the decision structure are not used, the memory is smaller than $2k^2$ for this example and states of the Markov chain can be appropriately collapsed. The conclusion is that the analyses

should be done if there is enough data, since most interactor's decision structures are probably not complex. This means that while memory may be greater than the prior three acts, say n acts, not all possible characteristics of that memory are useful for making a decision. This observation agrees with Barker's (1963) that interaction consists of sequences of various lengths.

Distortion: Memory can be distorted or misperceived. In this context perception means accuracy of memory of recent interaction. Perception does not mean empathy with other, discrimination of facial expression or detection of meaning in a word or sentence. It is assumed that the choices were perceived. But at some point, possibly instantly after reception, cognitive processes operate to change the meaning of the choice from what it was as received. The reason for misperceptions are motivational as can be seen in the kinds of misperceptions present in interaction. These misperceptions are dissonances from one's own choices, attributions to other's choices and punctuation concerning the ordering or grouping of choices (Watzlawick, Beavin and Jackson, 1967).

These three misperceptions can be usefully demonstrated formally as well as theoretically. To construct a perception matrix, each possible memory (sequences) becomes a row and also a column in the matrix. A cell entry represents the relation of memories. The measure in the cell is a conditional probability, the probability of a new memory (column) given an

old memory (row). If perception is accurate, the main diagonal of the matrix has ones. Misperception would be represented by non-zero probability in the off diagonal entries (See Figure 3).

Insert Figure 3 about here

The perception matrix can be partitioned into four parts. The upper right and lower left submatrices are zero. The two diagonal submatrices represent the possibilities for misperceptions, where other's choices are defined as attributions and those by self reflect dissonance.

The use of the terms attribution (Kelley, 1967) and dissonance (Festinger, 1957) follows usual usage. Attribution -is the process of placing other's choices in categories shared by the sender and receiver. Misperception or misattribution is the use by receiver of a different category than that used by the sender in making a choice. A dissonance effect cognitively recategorizes one's own choices. The reason for both these processes is that an interactor remembers interaction sequences as better or worse than they actually were. This distortion may be greater the longer the memory, the more extreme the value of a sequence and the more incongruent the sequence with strong, internal personality values.

Most models of interactions assume accuracy of perception (Raino, 1962; Abelson, 1967; Cervin and Henderson, 1961; Jaffe

and Feldstein, 1964; Rapoport and Chammah, 1965). Stimulus sampling theory models (Atkinson, Bower and Crothers, 1965) are the only class of models that allow for inaccurate perception. The reasoning behind this inaccuracy hypothesis is that only part of the information available to be processed is sampled. Furthermore, this sampled information is transformed into different information depending on the choices of the other person who functions as a controller of reward. Because 1) an interactor is assumed to be able to sample only part of the information and 2) this sampling is done independently from trial to trial and 3) the information is transformed based only on what other does, the probability of a choice changes in discrete jumps toward an equilibrium level. Choice probability changes more slowly over time than if full information were present, the main effect of this process (Coleman, 1964).

While this stimulus sampling conceptualization has received extensive support in highly constrained laboratory settings (Rosenberg, 1968, for a review), the veridicality-distortion hypothesis, because of its lack of specificity, allows personality and situational variables to be theoretically related to the accuracy transition probabilities in the perception matrix. How much inaccuracy is purely informational and how much motivational remains to be researched.

Decisions

We now move to a discussion of the linking of outcomes to

choices. A decision rule tells the interactor what to do given the valued consequences that follow from a choice. The first is a rationality rule.

Within the minimum bound of rationality, the greater the value of an outcome the greater the probability of a choice. At the maximum bound make a choice that brings the highest outcome value. However, an outcome value has interpersonal components that can be weighted in making a choice (Wolf, 1969). This interpersonal component decision rule makes rationality a matter of emphasis on what one can do for oneself and what one can do to or for other. This decision rule is discussed in detail elsewhere (Wolf, 1969).

A second rule might be uncertainty reduction. This means that choices are deterministic. Once the sequential pattern as remembered is known, a choice follows with probability one. This rule may be congruent with rationality, in that deciding deterministically brings the interactor the highest outcome value.

A last rule, out of the many more that might be noted, is information maximization. In this case choices might not be contingent on past choices. The greatest information occurs in coin flipping because one has the greatest ignorance. A similar idea but more related to conversation is that choices are made such that most of the $2k^n$ possible sequences are used. This decision rule might not be congruent with rationality

because it says to make choices that do not bring highest outcome value.

Which rule seems most appropriate to conversation and how it affects memory structures remain to be seen.

Outcomes

Valued outcomes that follow as a consequence of a choice have along history in the conceptualization of human behavior. Homans (1961) and Thibaut and Kelley (1959) in a theory of social exchange try to bring together operant learning theory (Skinner, 1953) and economic game theory (von Neumann and Morgenstern, 1944) for the purpose of understanding interaction. While the emphasis is on outcome values, Homans does not develop the sequential nature of interaction and Thibaut and Kelley, as in most gaming experiments, limit their analysis to a single outcome matrix and static or stationary sequences.

Formal models of sequential laboratory gaming interaction (Atkinson, Bower and Crothers, 1965; Rapoport and Chammah, 1965) or models of conversation (Abelson, 1967; Raino, 1962; Cervin and Henderson, 1961) treat outcome values as all or none in the model or as external to the model.

The conception of outcome values in this paper is that they are contingent on memory of recent history of interaction and are an explicit part of the model (to be presented formally in the next section). Each contiguous pair of choices, one by each interactor, can be thought of as producing an outcome

value for each interactor. This situation can be represented in an outcome matrix (See Figure 4). However, the values in an outcome matrix depend on the sequence that preceded the choices for a particular outcome matrix. Therefore, there could be as many outcome matrices as there are memory states. The interactors move from outcome matrix to outcome matrix based on the choices that are made. Each pair of choices moves the interaction to another memory and simultaneously the consideration of another outcome matrix. The problem becomes one of specifying what the values are in the set of outcome matrices.

Insert Figure 4 about here

A brief detour into laboratory gaming interaction provides a means of developing values for outcome matrices. In order not to have to measure the outcome values, most laboratory studies in dyadic interaction experimentally provide points, pennies or other commodities assumed to represent values in an outcome matrix. Because only a single outcome matrix is used, the memory should be zero if interactors are acting rationally. However, interactors do exhibit memory even in these highly constrained conditions. Interactors are not irrational but an hypothesis is that interactors transform the single experimental outcome matrices into a <u>set</u> of outcome matrices. The reason

for this is that the experimental outcomes change in value depending on how often and in what order they occur. Therefore, experimental supply of outcomes does not solve the problem but does suggest a way of determining outcome values.

Two principles inferred as present for individuals in non-social situations have been proposed many times over to explain why values of an outcome change over time. One is a satiation-deprivation principle and the other is a growth principle. Satiation-deprivation says that the more often or more recently a choice occurs, the less the value of its consequences and vice versa. The growth principle says the more often or more recently a choice occurs, the greater its value of its consequences and vice versa. Somewhere in between would be an hypothesis that the greater the variety of choices in a sequence, the greater the value of its consequences. One of these principles of change of value of an outcome can be applied in constructing the values in a set of outcome matrices. A principle would be applied by constructing a set of rules or axioms that map value onto distances between choices in a memory. These principles apply in an interpersonal context not just to single choices but also to combinations of choices by both interactors. Without further theoretical constraints, the possibilities for value mapping are so enormous as to be arbitrary.

As with decision rules and perceptual accuracy, the value problem is presented here as a basis for further analysis. In

the next section a formal model is presented that only partly solves the problem of value mapping and decision rules.

Formal Conversation Model

An intermediate alternative to generating value and decision rules sidesteps these problems by using a linear model that has as independent variables the memory states, an interactor's own present choices and other's subsequent next choices and a dependent variable of probability of own present choice:

$$5)\quad d_i^{k,h} = pr(A_t=k \mid B_{t+1}=h, S_{t-1}=i) = u + \alpha_h + \gamma_k + \theta_i + (\alpha\gamma)_{kh} + (\alpha\theta)_{ki} + (\gamma\theta)_{hi} + (\alpha\gamma\theta)_{khi} + e_{khij}$$

where,

A,B,S = random variables representing choices by by A and B and memory state S,

u = mean level of responses,

α_k = effect of own choice k,

γ_h = effect of other's subsequent choice h,

θ_i = effect of memory state i,

e_{khij} = error because of differences between interactors.

This model (5) is just an expansion of memory organization model (4) to include consequences in the form of other's next choice. Assuming independence of consequences is naive. Past choices are grouped according to states of memory. This similarity of the two models has advantages and disadvantages. On the one hand, the sidestepping of extimating values or utilities

of choices prevents a test of the kinds of decision rules used by an interactor. On the other hand, the interaction terms, $(\gamma\theta)$ and $(\alpha\gamma\theta)$, in model (5) provide a means of testing the hypothesis that memory occurs because of the differential value of outcomes dependent on memory. One can also test the relative effects of outcomes as compared to memory on choices and within each of these future and past orientations, the effects of self and/or other.

The use of the analysis of variance as a theoretical linear model and not just as a means for testing hypotheses has been applied mainly to problems of information processing, judgment, and integration (Anderson, 1968, 1970; Kelley, 1967). The present models, 4 and 5, are similar. Limitations in the model can occur from an inadequate or meaningless measurement of the dependent variable, floor and ceiling effects, response preferences and anchor effects. In the present models, probability is the dependent variable. On the one hand, floor and ceiling boundaries at zero and one often occur because of length of conversation constraints. On the other hand, if the phenomena do possess an n^{th} order memory, the dependent variable will theoretically approach zero or one. Transformation of the dependent measure does not change results. The use of the model in the present case is to suggest the approximate effects of the past and future on present choices. The actual underlying model would specify outcome values and decision rules.

Later in this section the use of this model is demonstrated through analysis of a sample conversation. To complete this section the time dependent observed sequential interpersonal choices, the time invariant decision, outcome and memory distortion structures are placed in a Markovian model.

The decision and memory accuracy structures explain the movement of interaction from memory state to memory state as follows:

$$6) \quad p_{ij} = \sum_{hk} d_i^{hk} c_{ij}^{hk}$$

where,

$\{d_i^{kh}\}$ = decision matrix of transition probabilities where $i = 1, 2v^n$ and k and h are choices by A and B, and v = number of available choices and n the length of memory.

$\{c_{ij}^{kh}\}$ = perception matrix of transition probabilities where memory states i and $j = 1, 2v^n$.

$\{p_{kj}\}$ = memory matrix of order (n) transition probabilities where $i = 1, 2m^n$ interaction sequences and $j = 1, 2m^n$ sequences.

Performance matrix p_{ij} is the square of the transition matrix in model (1) only if matrix C is an identity matrix I. Numerous properties of the interaction can be deduced by placing equation (6) in Markov Chain equation having similar definitions to equation (1):

$$7) \quad q^t = p^o(DC)^t E.$$

If the C and D matrices are known, then equation (7) predicts the probability of a choice at each trial, and the long run

probability of a choice. From equation (5) the effect of outcomes can be determined and from equation (4) the memory structure can be computed. In theory, an interactor knows the perceptual accuracy, the outcome values, and decision rules. From these he makes choices over time, receives some level of satisfaction and organizes his memory.

If optimal decisions are of interest, stochastic game theory can be used (Sobel, 1969). This model represents the importance of being able to model normative optimal decisions and to simulate actual decisions.

As a researcher the process is reversed. A sequence of choices is observed, and a set of outcome value matrices and a perceptual structure are hypothesized. From this the decision matrix, the outcome weights and the memory structure can be estimated, or linear model (6) can be used to sidestep extinction of values in structure. Using these results as estimates in Markovian model (7), statistical properties of the conversation can be predicted. Some of these might be the asymptotic probability and variance of choices and combinations of choices; the mean number of choices between particular pairs of choices; or the covariance of pairs of choices (Kemeny and Snell, 1960).

Having presented the structure of the quantitative properties of interaction, the formal model is demonstrated for a sample conversation. The procedure demonstrates the usefulness of the model in explaining conversation as two decision makers choosing

in the context of recent and future interaction sequences.

Unlike laboratory interaction under constraint, the number of messages an interactor may send before the other responds may be more than one. An often observed conversational patter is the "yes I agree but ... ". Therefore, two more categories are added: the agree-confronting and the agree-questioning. In this manner, the alternation property of conversation is maintained.

An analysis of a sample conversation follows by sequentially coding a fifteen minute conversation using the five responsive message codes. The conversation abstracted into these codes becomes fifty-five sequential choices of A-q-A-c-D-d-D-a-C-d-D-a-C-q-D-c-D-d-D-d-A-c-D-c-A-c-C-d-Q-a-Q-a-C-d-D-d-D-d-D-d-O-d-D-d-A-c-D-c-Q-c-D-d-D-a, where c and C = confronting, q and Q = questioning, a and A = complying, d and D = agreeing-confronting and o and O = agreeing-questioning. Small letter is one interactor's choice and the capital letter is the other interactor's choice.

The next step in the analysis counts the frequency of singles, pairs, triples and quadruples choices in a sequence. This analysis shows that half of the choices are agreeing-confronting. The lowest percent, ten, are questioning choices. Only confronting or only complying account for twenty percent each. The highest percentage, thirty, of choice pairs are agreeing-confronting followed by agreeing-confronting. The

lowest percentage involve questioning. A similar pattern holds for triples. Quadruples, four choices in a row, show that most quadruples occur with the frequency of one. An uncertainty analysis in Table 1 reports the percent of variance in a single choice accounted for by the prior three choices. This analysis supports the hypothesis that the conversation, or more precisely the memory of the interactors, is third order. This is because the lengrh of conversation boundary consideration has occurred.

Insert Table 1 about here

In order to determine the structure of memory and of immediate outcomes in relation to a choice an analysis using models (4) and (5) was done. Frequencies of sequences of length four were transformed into probabilities of a choice contingent on prior and subsequent choices. This was done by appropriately dividing each of the 1250(5x5x5x5x2) quadruples by 250 triples of the form choice-choice-blank-choice. Next this data was analyzed in a four way, repeated measures analysis of variance procedure. The results are reported in Table 2.

Insert Table 2 about here

Inspection of Table 2 yields results on memory organization, and outcome organization and decision rules. Before highlighting

these results, it is apparent that knowing that an interactor is making a choice is not enough to predict the choice.

There are main effects of own and other's ($F=6.52$; 4,4; .05) prior choices on the general level of responding. These effects stem from a relatively high probability of an agreeing-confronting message code and a low probability of an agreeing-questioning code. Own and other's prior choices operate in combination to effect the level of responding and the level of a particular message choice. The particular combination is agreeing-confronting or agreeing by self and agreeing-confronting by other. Based on these results, the number of memory states could be reduced from twenty-five to nine by making an equivalence class of messages agreeing, questioning and confronting. What makes a difference apparently in this conversation is whether an interactor sends one or multiple (two) messages when he speaks.

In a fashion similar to the effects of memory, other's subsequent choice, an outcome, operates in several ways. It affects the general level of responding ($F=12.77$; 4,4; .025) and the specific responding levels ($F=6.29$; 16, 96; .01). It also interacts with other's prior choice ($F=2.24$; 16, 96; .05) and own and other's prior choices ($F=2.47$; 64, 256; .01) to effect general level of responding and particular message probabilities ($F=1.88$; 64, 256; .01; $F=2.94$; 64, 256; .01; $F=2.17$; 256, 256; .01). The result supports the hypothesis that memory occurs because consequences are related to memory in

determining choice probability.

In this analysis outcome structure is intimately related to decision rules. One cannot distinguish between the uncertainty reduction decision rule and interpersonal decision rules. If the latter were used, one can conclude that an interpersonal choice puts weight on what the other is expected to choose both independent of and dependent on what self chooses, with the latter having a stronger relation. There is no effect of own choice along.

Markovian model (7) and verdicality-distortion process are not explored in detail in this conversational example. To test these properties, the conversational data would be grouped into blocks with choice probabilities estimated for each block. Predictions of these trial block probabilities would follow using various structures for the perception matrix. A criterion such as mean square error could determine adequacy of fit. With all the degrees of freedom available, fit should not be difficult. But this is also the reason for not analyzing until some further structure is given to the process and the ratio of parameters to degrees of freedom becomes more favorable.

Conclusion

This paper began by defining conversation as the alternation of pro and con opinions between interactors that emphasizes the sequential and discrete nature of interaction. After

reviewing the few studies that have analyzed natural interaction sequentially, a theoretical framework was proposed: interactors are decision makers who generate choices over time based on a memory of the recent past and an expectation of immediate future outcomes.

This framework led to hypotheses about memory's size, organization, and distortion, about decision rules, and about outcome structures and value determination. An interactor's memory links past to present and features size, organization and distortion. Memory limits its own size absolutely, through the length of conversation and the number of choice alternatives, and relatively through a trade off between greater prediction of outcomes and cost of information processing. Memory organizes past choices hierarchically. Single choice links are called cues and combination links are feedback. Memory distortions by the receiver of a message attribute other's or own choices to categories different from those produced by the sender. The effect of this is to delay the rate at which the conversation moves toward asymptote. A few decision rules relating outcomes to choices are impersonal and interpersonal rationality, uncertainty reduction, and information maximization. Values formed in memory through the distance between choices or combinations of choices and organized according to which interactor controls how much of an outcome's value.

The various hypotheses were partially used in formal models that represent these processes. A sample conversation was analyzed tc demonstrate the models and not to draw support for hypotheses. Many hypotheses can be represented through this model. Future work involves estimating parameters in particular situations and perfomring sensitivity analyses on the parameters.

Table 1

Uncertainty Analysis

ML[1]	CL[2]	NM[3]	JC[4]	EU[5]	UC[6]	UE[7]	JP[8]	LP[9]	LP[10]	PUE[11]
1	55	9	2.850	1.673	1.177	.586	4.027	1.673	1.177	.586
2	54	22	4.027	2.105	.745	.738	4.256	1.444	1.406	.506
3	53	33	4.773	2.430	.419	.852	4.370	1.330	1.520	.466
4	52	40	5.193	2.577	.273	.904	4.312	1.388	1.461	.487
5	51	46	5.466	2.752	.098	.965	4.271	1.430	1.420	.501
6	50	48	5.565	2.845	.004	.998	4.205	1.495	1.355	.524
7	49	48	5.569	2.852	-.001	1.000	4.223	1.477	1.373	.518
8	48	48	5.568	2.891	-.040	1.014	4.187	1.514	1.336	.531
9	47	47	5.527	2.880	-.030	1.010	4.190	1.510	1.340	.529

1. Memory Length
2. Conversation Length
3. Number of Memory States Used
4. Joint Combination Uncertainty
5. Explained Uncertainty in Choice Combination
6. Error Uncertainty in Choice Combination
7. Percent of Uncertainty Explained by Combinations
8. Joint Pair Lag Uncertainties
9. Explained Uncertainty in Lagged Pairs
10. Error Uncertainty in Lagged Pairs
11. Percent of Uncertainty Explained by Lagged Prior Choice in Lagged Pair

Table 2

Effects of Interpersonal Memory and Outcomes on the Probability of Interpersonal Choices

Source	S.S.	df	Ms	F	P
Between error	.007	1	.007		
Within					
A(Own choice)	.539	4	.135	5.40	N.S.
error	.101	4	.025	-	
B(Own prior choice)	.427	4	.107	8.23	.05
error	.052	4	.013	-	
C(Other's prior choice)	.443	4	.111	6.52	.05
error	.069	4	.017	-	
D(outcomes)	.667	4	.166	12.77	.025
error	.052	4	.013	-	
AB	.516	16	.032	1.88	.05
BC	1.093	16	.068	4.00	.01
AC	1.261	16	.079	4.65	.01
AD	1.717	16	.107	6.29	.01
BD	.349	16	.022	1.29	N.S.
CD	.613	16	.038	2.24	.05
error	1.650	96	.017	-	
ABC	2.403	64	.038	2.37	.01
ABD	2.067	64	.032	1.88	.01
ACD	3.043	64	.047	2.94	.01
BCD	2.691	64	.042	2.47	.01
error	4.244	256	.016	-	
ABCD	9.453	256	.037	2.17	.01
error	4.323	256	.017	-	

Figure Captions

Figure 1. Graph of maximum memory record length or order and number of states of memory for conversations of differing length and differing number of choices.

Figure 2. Perception matrix representing possible distortions in memory of recent sequences of interaction.

Figure 3. An outcome matrix.

Figure 4. Analysis of elementary pro and con conversational choices and the derivation of responsive conversational choices.

Figure 1

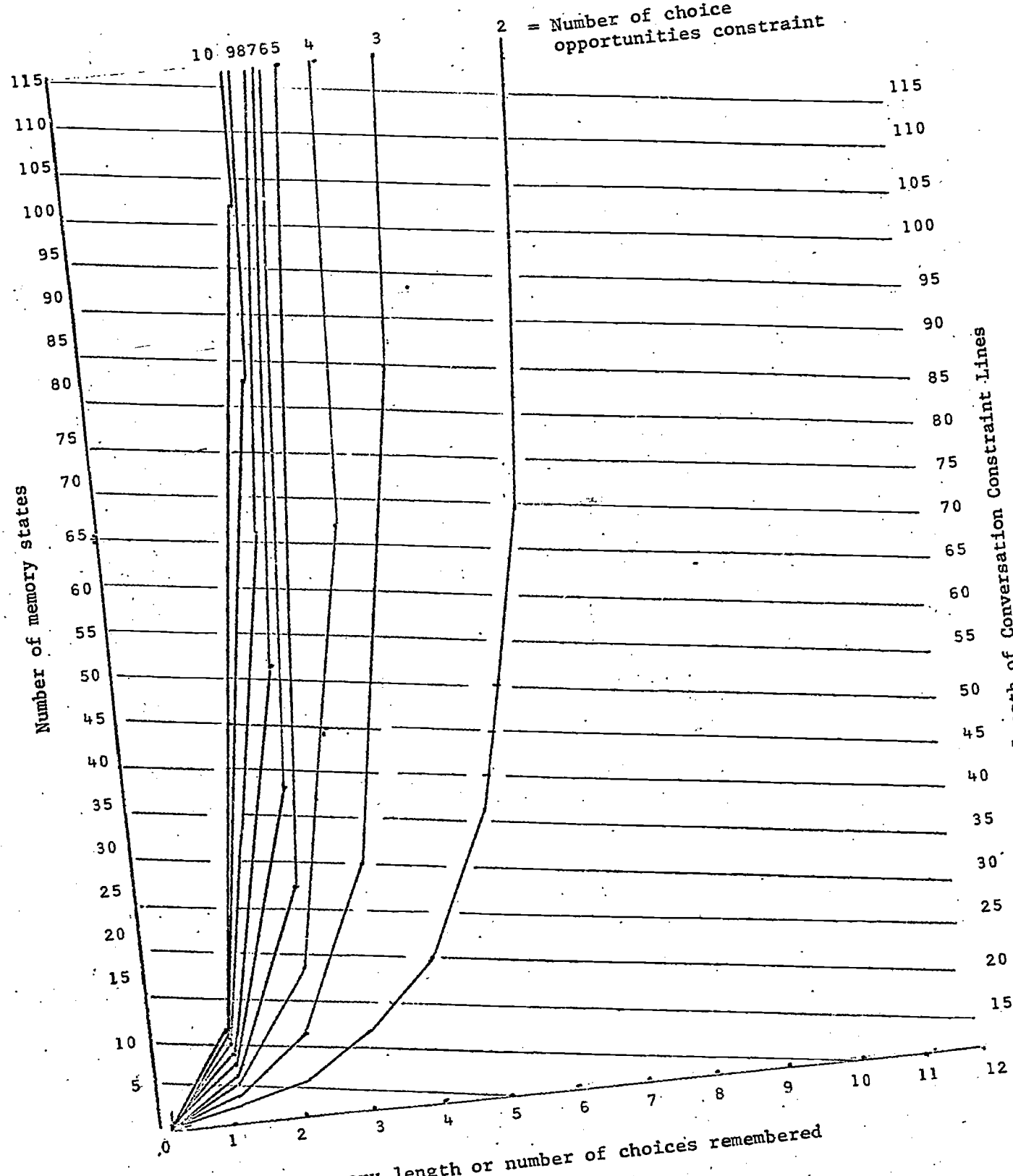
10 9 8 7 6 5 4 3 2 = Number of choice opportunities constraint
Number of memory states
115 110 105 100 95 90 85 80 75 70 65 60 55 50 45 40 35 30 25 20 15 10 5
Length of Conversation Constraint Lines
115 110 105 100 95 90 85 80 75 70 65 60 55 50 45 40 35 30 25 20 15
0 1 2 3 4 5 6 7 8 9 10 11 12
Order, memory length or number of choices remembered

Figure 2

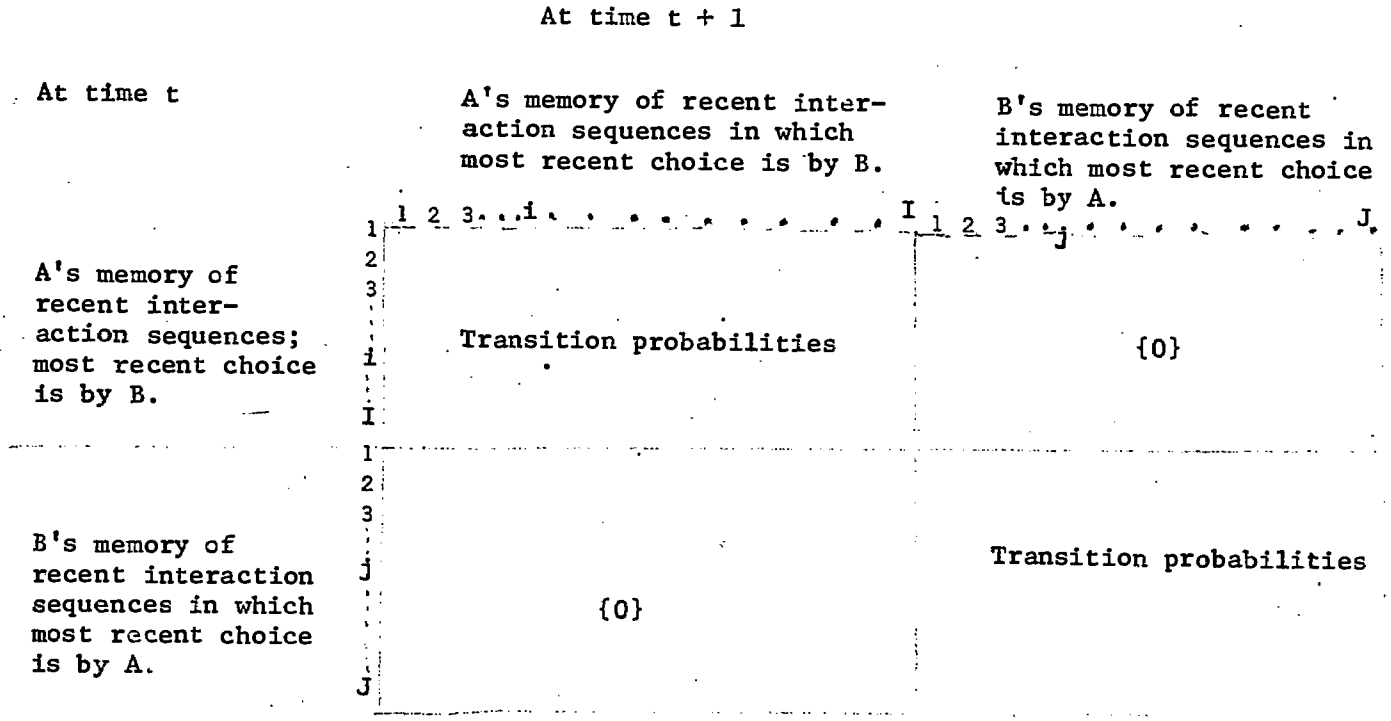
At time t + 1
At time t
A's memory of recent interaction sequences in which most recent choice is by B.
B's memory of recent interaction sequences in which most recent choice is by A.
A's memory of recent interaction sequences; most recent choice is by B.
B's memory of recent interaction sequences in which most recent choice is by A.
Transition probabilities
{0}
{0}
Transition probabilities

Figure 3

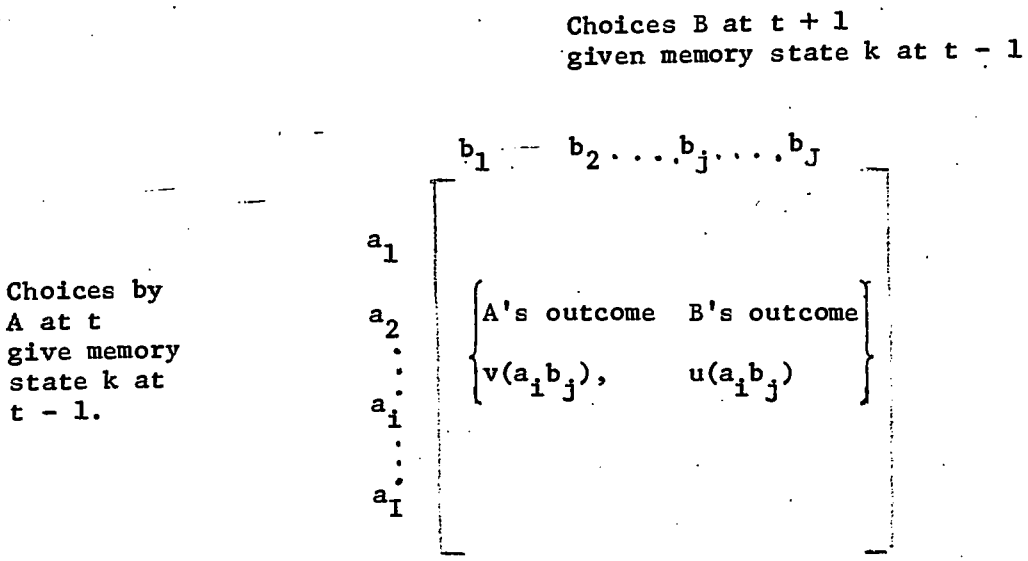
Choices B at t + 1
given memory state k at t - 1
b_1 b_2 . . . b_j . . . b_J
Choices by
A at t
give memory
state k at
t - 1.
a_1
a_2
a_i
a_I
A's outcome B's outcome
$v(a_ib_j)$, $u(a_ib_j)$

Figure 4

Person A's Present Choices	Person B's Subsequent Choices: Seeks Pro	Seeks Con	Offers Pro	Offers Con
Seeks Pro	{B questions}		B answers - CONFORMS	B does not answer - CONFRONTS
Seeks Con			B does not answer - CONFRONTS	B answers - CONFORMS
Offers Pro			B argues - CONFORMS	B disagrees - CONFRONTS
Offers Con			B disagrees - CONFRONTS	B agrees - CONFORMS

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Behavioral Patterns in Goal Setting Conferences

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Behavioral Patterns in Goal Setting Conferences

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Report No. 32, April 1970.

Prepared for the Joint Committee administrating the pilot Professional Development and Appraisals Program for the Westport School System, April, 1970, for the purpose of describing and documenting behavior within goal setti , meetings during the school year 1969-1970.

Educational innovation comes in many forms. There have been programmed learning, individualized learning and group training. The Westport Professional Development and Appraisals Program works on participation in arriving at behaviorally defined goals.

This program is built around the idea that if superiors sit down with subordinates, throughout the organizational hierarchy, and work at setting concrete, behavioral goals, benefits will accrue to all participants. Some of these benefits are outlined in the reasons for this report.

The behavioral patterns occurring in goal conferences are the focus of this report. The reasons for this focus are at least four. The four are: reasons from the total system's point of view, the joint committee's reasons from the teachers' viewpoint, and reasons of the writer-observer.

1. The system's reasons, outlined in the original project proposal, for looking at behavior in goal meetings center on the organization of the system and the person's role in it. Just as students clamor for control and relevance in their educational life, so might the teacher in his or her way. It almost goes without saying that to be more effective and independent is desired by many throughout an organizational hierarchy. The reasons for the lack of control, relevance, and effectiveness by a person in an organizational hierarchy may not have so much to do with the division of labor in an organization's hierarchy itself, as it does with being able to understand the organization's goals at various levels, and being able to judge one's own goals in relation to the organization's goals.

Continuing these thoughts, for students to come to grips with the

relations of their goals to the teacher's goals, the teacher must come to terms with the relation of his or her goals to his or her superior's goals. This relation has often been one-way and one-down, particularly in reference to what the teacher should do and how he is evaluated when he has done it. Goal meetings then are a microcosm of the total school system. And evaluating the meetings may shed light on the system as well as the conferences themselves.

2. From the Joint Committee's viewpoint, like any innovative attempt, there are successes and failures on several dimensions. Some of these dimensions for example, might be the strengthened competence of the students, the attitudes of the teacher, the success of the teacher in relation to the goals, or the behavior of the participants in goal conferences. This report looks only at the last of these possibilities. Particular characteristics of this dimension are described in later sections. The report's results should be compared with other evaluations of the program: those by the Joint Committee's analysis of the actual goals that were set and the questionnaire analysis of the teachers' attitudes.

3. From the teachers' practical viewpoint, the goal setting meetings served as substitutes for the traditional means of teacher evaluation. In the past teachers were visited in the classroom by superiors and then, maybe, given feedback. This feedback would often be minimal and unilateral. The goal conferences, designed with impetus from the teachers, provide a means for altering the conditions of evalution. This study provides data that can be compared with results from traditional teacher evaluation settings. While plans for the study included collection of data from traditional evaluation meetings, these plans were not feasible. Therefore, this comparison will have to be informal.

4. From the writer-observer's point of view, the goal conferences are a situation in which to study interaction patterns, a central research concern. These results may eventually be compared with results from other settings in which the observational coding system has been used (Longabaugh, 1966).

With these reasons for examining goal setting meetings, the following sections of the paper include discussions of the sample characteristics, setting of the conferences, how conferences were observed and conceptualized, results of the observations, and interpretation of results with recommendations.

Sample Properties

The following table quickly summarizes how the volunteers for the pilot study are approximately distributed according to position in the organization. Only a small part of the total education system participated in the project. Participants were selected by departments volunteering. However, not all the tenured teachers in a department eventually participated. The size of the sample of meetings is also listed according to presence or not of the consultant and persons' positions in organizations.

Relationship of Organizational Positions	Full Project		Sample of Meetings Attended by Obser.			
	Relationships	Meetings	Consultant	No Consultant	Total Freq.	Percent
Superintendent-Assistant Superintendent	3	9	2	0	2	(.22)
Assistant Superintendent-Principal or Director	8	24	1	2	3	(.12)
Principal-Chairman	4	12	1	0	1	(.08)
Tenured Teacher-Chairman	8	24	2	2	4	(.16)
Nontenured Teacher-Chairman	25	75	2	3	5	(.07)
Totals	48	144	8	7	15	(.10)

The full project figures are estimates and not actual occurences of meetings or people. This is because some persons actually had more than three meetings and some had less. The latter is particularly true at middle levels of the organizational hierarchy.

The sample itself was not strictly randomly selected nor could it have been. It was selected sequentially each week through the observer receiving weekly schedules of all meetings. If more than two meetings were scheduled for a Wednesday, Thursday, or Friday, he would try to attend. However, meetings fell through at the last minute or others were added without the observer's knowledge. The obvious effect of this procedure is to have a small sample, consisting of about ten percent of all meetings.

This sample is particularly underrepresented in non-tenured teachers and principals interacting with chairmen.

It would have been desirable to have a larger sample. This sample would have included 1) evaluation meetings of teachers not in the program and 2) final evaluation meetings concerning the success of goal accomplishment. Neither of these groups are represented in the sample, except for two intermediate meetings. The present sample consists mainly of initial goal setting meetings. If the sample were larger, analyses could have been done according to grade (primary, junior high, and high school) and the amount of learning.

The consultants are members of Genova's Training, Development and Research staff from Boston. They conducted several afternoons of training for the participants prior to the program in the fall. Also they consulted something less than a fourth of the goal conferences during the year.

Two of the fifteen meetings are repeats on the same person. Several meetings involve the same superior. And several of the meetings involve the same person, who is however, in different positions or roles in the organization. The reason for mentioning these properties is to further demonstrate a lack of representativeness and possible biases in the sample.

Conference Setting

Conferences for teachers were held in the teachers' school building and top administrators' conferences were held at the TSO. Offices or conference rooms were usually used with several periods set aside for a conference. If the observer were present, his role was briefly discussed along with the reasons for audio taping the sessions. It was explained that the tapes were to be used as a help in the coding of observed behavioral patterns. During the conference the observer sat to the side and took notes

and did some on-the-spot coding. If a consultant were present, his comments were often reserved until the end or opportune points of transition. The time of day of a conference varied extensively as did the length of the conference. Some lasted half an hour and others up to three hours.

Three conferences were scheduled for each subordinate. The first set goals which were written down using specified forms developed by the consultants. These forms included such things as criteria for evaluating performance. The second meeting was a check to see how progress toward the goal was moving. The last was to evaluate the success of performance in relation to the goal. As previously noted, the latter two kinds of meetings were rarely observed.

[illegible] for Analyzing the Conferences

Three properties follow from the reasons for having goal setting meetings. These three properties are mutuality, communication and commitment. They have particular definitions for this study which lead to ways to measure behavior in the conferences.

Mutuality means the degree to which each person, superior and subordinate, contribute to the interaction. The emphasis is on the give and take of exchange. Without each putting something in and getting something out, goal setting would not be mutual. What is exchanged are proposals for goals and means for achieving the goals, evaluation of the goals, and lastly, information concerning the content of the goals to be set.

Interactors could each contribute to the conference, but not necessarily be listening or responding to the other person. Communication labels the ideas of listening and responsiveness. An indicator of listening is the extent of helping the other to express himself by seeking out his thoughts.

Responsiveness can be observed by noting what is said in response to the other person as compared to oneself. For example, does offering agreement occur more often in response to an agreement by the other person or in response to an agreement by oneself?

Even though interactors may contribute and listen to each other, they may avoid confrontation about a goal because of the conflict associated with the confrontation. Also, subordinates tend to have greater fear of confronting than do the superiors. Who confronts in the form of disagreement, differences of opinion, or non-compliance with the direction of the goal setting is what is meant by commitment. If confrontation is low, then the interactors can sail through a goal conference without becoming involved, defeating a reason for having the conferences.

Implicit in the conceptualization of goal conferences as involving mutuality, communication and commitment, is a way for measuring these properties (Longabaugh, 1963). The measuring is done by coding into one of several categories what a person says. First, one notes whether the person is conveying resources of information about, evaluation of, or suggestions for a goal or means for reaching the goal. Secondly, one checks if the person is offering the resource to the other person or seeking the resource from the other person. Lastly, is the resource similar or dissimilar to what the other just talked about? If it is similar, the episode continues in a similar vein. Dissimilarity means that the episode takes on a new direction. The following Table summarizes the definitions of these categories.

Category	Definition	Example
A. Resources		
1. Information	Description of the goal,	"This report I am

Category		Definition	Example
		means for reaching the goal or criteria for evaluating the goal.	writing on individualized learning will include a review of studies on the topic."
	2. Evaluation	Evaluation of the goal, means, or criteria.	"I don't think you need to include a review of other studies."
	3. Direction	A proposal for a goal, means, or a criteria.	"Why don't you write a report of your findings on individualized learning?"
B. Mode			
	1. Offering	Giving of information, evaluation, or direction.	"I don't think this goal is a good one."
	2. Seeking	Seeking of information, evaluation, or direction.	"Do you think writing a report is a way of evaluating this goal?
C. Episode			
	1. Continues	Agrees, complies and continues discussion.	"Yes, a report is a good idea. What will go into it?"
	2. Discontinues	Disagrees, and changes discussion.	"No, a report will not satisfy the evaluation of goal completion. Let's think of something else."

Three or four of the conferences were transcribed and the coding system was developed and tested on these transcripts.

During a conference notes were taken by the observer. Following a conference, the observer listened to the audio tape of the conference and coded the participations by each person at the conference into

the categories. Each participation was coded for the kind of resource, mode and episode. The total conference as a sequence of these categories was then punched on IBM cards for purposes of analysis. Before analysis, another observer, trained in the coding system listened to some of the tapes and coded the discussion. This coding was compared with the original coding for the purpose of determining if both coders identified the behaviors as being in the same categories. The percent of agreement, called a reliability, between coders of the frequency of behaviors in each of the categories was .84. This means that the discussions can be considered as having been coded relatively reliably, that is the coders saw the discussions the same way.

Results

This part reports the mean frequency of the just described behavioral categories. This is done for superior and subordinate 1) irrespective of external conditions, 2) at different levels of the organization and 3) for the consultant present and not present.

The complete table of mean frequencies is displayed in Appendix 1. The following highlights significant results from this complete table. Statistical analyses (analysis of variance) were performed that support the following results. Conclusions are based on twelve conferences. Three conferences were not statistically analyzed because of inadequate data (See Appendix 2).

Averaging over all persons, a person sought resources from the other person about five times less often than he presented resources to the other. However, superiors sought three times less often than they presented

as compared to the subordinates nine times less often. In social exchange it is not necessarily more blessed to give than to seek, being able to admit ignorance and ask for the other's ideas is a way of creating mutuality and a dialogue. Therefore, the superior appeared to make some efforts at soliciting the views of the subordinate. These efforts were greater than the subordinate's solicitation of the superior's views.

Looking at the mean frequency of resources, we find that the direction resource occurred least often. Information occurred twice as often as direction. Compared to interactions in other settings, it is surprising that evaluation occurred more often than information. It should be further noted that superiors use the direction resource more than the subordinates while the subordinates use the evaluation resource more than the superior. The reasons for this emerge by looking at how resources are used in combination with modes and continuations.

Before looking at these combinations, we shall look at how often continuations occur. Continuations on the same topic occur four and a half times more often than do changes in topic. Changes are more often initiated by the superior than by the subordinates. This result might be expected according to the roles of superior and subordinate.

Putting together the results discussed so far, we would predict that subordinates tend to offer similar evaluations to, that is agree with, evaluations and directions initiated by the superior. Congruent with this prediction we see that the superior initiates a change by seeking different information or an evaluation, or less often by offering information or direction. He continues discussion on the topic by offering similar evaluations, informations or directions. By contrast, the subordinate does not change the topic as often as the superior and when he does, it is accomplished by offering different information rather than

seeking the superior's views. The subordinate continues the discussion by typically agreeing with the superior or offering similar information.

These results generally held up for conferences for non-tenured teachers and higher levels of management. Tenured teachers exhibited slightly different patterns of behavior. They sought the superior's ideas almost as often as the superior sought out the tenured teacher's ideas. However, the superior still initiated more directions and the subordinate initiated more offering of agreements.

The behavior effects of the consultant, as shown in the appendix, were slight. The consultant attempted to have persons look at what they had been doing by seeking their impressions. People usually responded by overtly agreeing with what the consultant was driving at. However, in this gross analysis, there was little change in the amount of seekings from the subordinate or superior, or in who initiated the topics of discussion. The effects of the consultant's interventions might occur in subsequent conferences but the small amount of data prevented an analysis of this prediction.

As a further verification of the subordinates' dependence on the superior, the coded behaviors were analyzed serially. This was done by counting the frequency of patterns of three behaviors in a row. From this computation, statistical tests (uncertainty analyses) were made to see to what extent what one said was related to what the other just said and to what oneself had just stated (Wolf, Longabaugh, and Eldred, 1969; Wolf, Hayes and Meltzer, 1969).

This analysis showed that subordinates were more dependent on what the superior said than on what the subordinate himself said. This relationship was reversed for the superior. He was more dependent on what

he himself said than on what the subordinate said.

The typical behavioral patterns that constitute this relationship were the superior seeking or offering an idea, the subordinate continuing in the same vein followed by further ideas from the superior. After several more continuations from each person, the superior usually would seek or offer another idea. The kinds of ideas were quite varied so that typical patterns could not be pinned down any more precisely than this.

These patterns were not analyzed by level in the organization or by the presence of the consultant. Interpretations of these results in the light of on-the-spot observations and experience of the observer follow in the next section.

Interpretation

The results will be discussed and amplified by putting them in the context of impressions from the on-the-spot observations and by relating the results to the concepts of mutuality, communication and confrontation.

On-the-spot observation showed that little time was spent in selecting a goal. While this phase of goal selecting might have taken place in casual meetings prior to conferences, it seemed that the subordinate usually had some goals in mind. The superior in turn put himself in the role of responding to the subordinates' goal proposals. This eventually had the effect of minimizing bargaining over goals. The superior might have taken this position because he did not want to be domineering. However, while guarding against dominating, he subtly took control by letting the subordinate propose and he dispose.

Much of the time was spent in trying to shape the goal into proper proportions. These proportions include scope, viability, appropriateness

and specificity. With these issues worked through, criteria for evaluating goal performance were not difficult to come by. Less technical questions of challenge and riskiness were not usually reviewed. In a well functioning conference, these properties might be effectively discussed also.

For these reasons, analysis centered on qualities of the interactions. The qualities we were looking for were mutuality, communication and commitment. These were selected as being essential to interaction during goal setting conferences because interaction in these settings was thought to call for bargaining and exchange.

We saw that subordinates tended to put more into the interactions in terms of the offering of resources. This was because, evidently the superior usually did not have goals to propose and because the superior pushed the subordinate for ideas through his asking of questions. Mutuality might have been greater if the superiors offered resources over which to bargain and if the subordinate offered more specified proposals so that the superior did not end up acting like a teacher going over a student's exam.

In turn subordinates tended to wind up responding to the superior's questions. Communication might have been better if the subordinate helped the superior explore his thoughts through appropriate questions. If this happened one might see the subordinate being less dependent on the superior as observed in the superior-questions, subordinate-answers sequence.

Turning to the issue of commitment, the behaviors that indicate this variable are difficult to identify. Commitment is often thought of as a subjective feeling. This feeling may be exhibited in many ways. One of the ways proposed for this situation is the extent to which each

person in the interaction confronts the other person with his wishes and views, but in a way that the other does not become defensive by changing the conversation.

The superior did more changing of direction of the conference than did the subordinate. In terms of commitment and confrontation, the superior usually questioned details of the goal rather than whether a goal was good for the teacher from the superior's point of view. Also the subordinate did little confronting of the superior in that goals were proposed that generally did not raise very much disagreement.

Commitment and confrontation have particular relevance to traditional methods of evaluation. The goal conferences were designed so that superior and subordinate might jointly work on important issues that were only partially approached unilaterally before. Based on the present analysis, a confronting on important issues usually did not take place. Instead relatively safe goals were chosen and worked on.

There were exceptions to these patterns. There seemed to be greater variance at higher levels of management with greater conflict and greater avoidance of conflict. Middle levels of management experienced the often found double pressures of demands from below and demands from above. Tenured teachers seemed more confident, as might be expected, because their jobs were not on the line. Non-tenured teachers generally worked hard to please in hopes that their jobs would be renewed.

It was difficult to assess the effects of the consultants. In any one conference not too much could be accomplished. Probably the greatest effects took place during conferences the consultants had with participants when they requested help and had specific problems to work on. The consultants might have been more effective with examples of good

and bad episodes role played during the work shops in the fall and during the conferences.

With this first year by the boards and the experience gained through it, the program could become more effective in the ensuing year. To become effective, more persons need to fully participate so that any one person does not feel like a lone sheep. Goals must be selected that represent real concerns to the participants. Participants must experience successful conferences and know when the conference has been successful and unsuccessful and why.

Longabaugh, R. A category system for coding interpersonal behavior as exchange. Sociometry, 1963, 26, 319-344.

Longabaugh, R. The structure of interpersonal behavior. Sociometry, 1966, 29, 441-460.

Wolf, G., Hayes, D. P. and Meltzer, L. Units, sampling, and models of sequential dependencies in social interaction. Administrative Sciences, Report No. 19, Yale University, 1969.

Wolf, G., Longabaugh, R. and Eldred, S. Sequential constraint in interpersonally coded messages. Administrative Sciences Report No. 7, Yale University.

*Rows sum to 1

Appendix 1

Mean relative frequency of behavioral categories by role in the organization, organization level, and consultant's presence

Behavioral Categories

MODES:		Seeks						Offers					
RESOURCES:		INFORMATION		EVALUATION		DIRECTION		INFORMATION		EVALUATION		DIRECTION	
Episodes:		Continue	Discontinue	Continue	Discontinue	Continue	Discontinue	Continue	Discontinue	Continue	Discontinue	Continue	Discontinue
ROLE	N												
Superior	12	047	071	029	062	013	019	139	048	396	029	121	034
Subordinate	12	022	028	017	013	013	008	209	031	553	027	074	011
Average	(24)	034	054	023	038	013	014	174	039	475	028	098	022
Top Management													
Superior	4	061	110	025	061	009	034	121	041	348	035	119	049
Subordinate	4	019	013	013	002	019	009	295	042	502	029	082	011
Tenured Teacher													
Superior	4	029	036	026	031	009	018	107	063	479	033	099	029
Subordinate	4	011	021	029	029	004	007	087	021	641	031	061	004
Non Tenured													
Superior	4	058	064	041	044	027	009	195	052	307	029	155	034
Subordinate	4	042	049	014	012	020	017	249	038	489	028	091	024
Consultant Present													
Superior	6	051	061	028	059	007	002	175	051	354	034	101	034
Subordinate	6	037	042	025	013	003	001	233	033	549	039	081	015

Appendix 1 continued

Behavioral Categories

MODES:		Seeks						Offers					
RESOURCES:		INFORMATION		EVALUATION		DIRECTION		INFORMATION		EVALUATION		DIRECTION	
Episodes:		Continue	Discontinue	C	D	C	D	C	D	C	D	C	D
ROLE	N												
No Consultant													
Superior	6	047	077	033	039	020	016	102	050	397	.029	139	039
Subordinate	6	011	015	015	017	022	016	180	031	.525	.031	.071	011

Appendix 2

Analysis of Variance of the Statistical Effects of Organization Level, Consultant Role Position and Behavioral Category on the Probability of a Behavioral Category

Sources of variance	df	MX($\times 10^{-7}$)	F ratio	Prob	df	MS	f	f Pr	df	MS	F	Pr
Between Conferences Factors	11											
Organizational Level	2	1957	-									
Consultant	1	12333	5.93	.05								
Organ X Consultant	2	1072	-									
error	6	2078										
Within Conferences Factors	276											
	Irrespective of Between Factors				Interaction with Organization				Interaction with Consultants			
Superior-subordinate	1	802	-		2	748	-		1	517	517.0	.05
error	1	5831			2	459			1	1		
Mode of Behavior	1	2006609	55,739.2	.001	2	1047			1	6969	18.2	NS
error	1	36			2	1082			1	389		
Resources	2	549373	45.5	.05	4	14879			2	6005		
error	2	12075			4	12128			2	7227		
Episode	1	1,771,115	590,371.6	.001	2	8238	4.3	NS	1	4501	10.0	NS
error	1	3			2	1897			1	451		
Sup-Sub X Mode	1	81,494	123.5	NS	2	6680	6.3	NS	1	8749		

Sources of Variance	df	MX($x10^{-7}$)	F ratio	Prob	df	MS	f	Pr	df	MS	F	Pr
error	1	661			2	1069			1	375		
Sup-Sub X Resource	2	36,747	239.8	.01	4	10541	4.9	NS	2	5017	1.4	NS
error	2	149			4	2154			2	3389		
Sup-Sub X Episode	1	92,029	30.6	NS	2	8879	5.6	NS	1	11599	8.3	NS
error	1	3001			2	1578			1	1389		
Mode X Resource	2	494483	100.2	.01	4	2941			2	5392		
errpr	2	4932			4	7055			2	9068		
Mode X Episode	1	1985551	220616.6	.001	2	3959	16.1	NS	1	5227		
error	1	9			2	244			1	4156		
Resource X Episode	2	515394	47.2	.05	4	10726	1.3	NS	2	6422	1.3	NS
error	2	10912			4	7368			2	5708		
Sup-Sup X Mode X Resource	2	64462	9.3	NS	4	28375	5.4	NS	2	8138	2.7	NS
error	2	6877			4	5236			2	2987		
Sub-Sup X Mode X Episode	1	40499	38.4	NS	2	6761	25.5	.05	1	5723	31.7	NS
error	1	1051			2	265			1	180		
Sub-Sup X Resource X Episode	2	35105	7.6	NS	4	4002	13.7	.05	2	7491	5.4	NS
error	2	4757			4	1020			2	1387		

Appendix 2 continued

Sources of Variance	df	MX($x10^{-7}$)	F ratio	Prob	df	MS	f	Pr	df	MS	F	Pr
Mode X Resource X Episode	2	512330	91.3	.01	4	6288			2	9374	1.6	NS
error	2	28884	49.8	.05	4	8199			2	5697		
S-S X Mode X Research X Episode	2	28884	49.8	.05	4	21417	14.3	.05	2	4599	63.0	.05
error	2	580			4	1491			2	73		